Notice of Allowability	Application No.	Applicant(s)	
	10/698,002	SAKURADA ET AL.	
	Examiner	Art Unit	
	Sow-Fun Hon	1794	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the amendment dated 11/13/07*.

2. ☒ The allowed claim(s) is/are *1-2*.

3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
      1. ☒ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date *12/05/07*.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☒ Other *See Continuation Sheet*.

Continuation of Attachment(s) 9. Other: The drawings filed 10/30/07 are accepted by the examiner.

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Michael Hilton on Wednesday, December 05, 2007.

The application has been amended as follows:

2. Cancel claim 3.

3. Rewrite claim 1 as:

- - A process for producing the organic semiconductor element of claim 2, ~~an organic semiconductor material having rodlike low-molecular liquid crystallinity, comprising: a skeleton structure comprising L 6 π electron aromatic rings, M 10 π electron aromatic rings, and N 14 π electron aromatic rings, wherein L, M, and N are each an integer of 0 (zero) to 4 and L + M + N = 1 to 4; and a terminal structure attached to both ends of said skeleton structure, said terminal structure being capable of developing liquid crystallinity,~~ said process comprising: providing an organic semiconductor material that has rodlike low-molecular smectic liquid crystallinity, and comprises a skeleton structure comprising: L 6 π electron aromatic rings, M 10 π electron aromatic rings, and N 14 π electron aromatic rings, wherein L, M, and N are each an integer of 0 (zero) to 4 and L + M + N = 1 to 4; and a terminal structure

attached to both ends of said skeleton structure, said terminal structure developing smectic liquid crystallinity; repeatedly purifying the organic semiconductor material to remove impurities such that the organic semiconductor material has a charge mobility not less than 5×10^{-3} cm^2 V^{-1} s^{-1} when in a crystalline phase and not less than 5×10^{-2} cm^2 V^{-1} s^{-1} when in a liquid crystal phase, and the phase angle Θ of impedance of said organic semiconductor material is $-80^\circ \leq \Theta \leq -90^\circ$ as determined in the measurement of impedance in a frequency f range of 100 Hz ≤ f ≤ 1 MHz when said organic semiconductor material in an isotropic phase state is held between a pair of opposed substrates with an interelectrode spacing of 9 μm; heating said organic semiconductor material to a temperature high enough for the organic semiconductor material to exhibit at least a smectic phase and then cooling the organic semiconductor material so that at least part of the organic semiconductor material is in a crystal phase.

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4. Rewrite claim 2 as:

- - An organic semiconductor element comprising a functional layer comprising an aligned organic semiconductor material wherein the organic semiconductor material ~~having~~ has rodlike low-molecular smectic liquid crystallinity, and comprises a skeleton structure comprising: L 6 π electron aromatic rings, M 10 π electron aromatic rings, and N 14 π electron aromatic rings, wherein L, M, and N are each an integer of 0 (zero) to 4 and L + M + N = 1 to 4; and a terminal structure attached to both ends of said skeleton structure, said terminal structure ~~being capable of~~ developing smectic liquid crystallinity,

the charge mobility of said organic semiconductor material is not less than 5×10^{-3} cm^2 V^{-1} s^{-1} when in a crystalline phase and not less than 5×10^{-2} cm^2 V^{-1} s^{-1} when in a liquid crystal phase, and the phase angle Θ of impedance of said organic semiconductor material is $-80^{\circ} \leq \Theta \leq -90^{\circ}$ as determined in the measurement of impedance in a frequency f range of 100 Hz $\leq$ f $\leq$ 1 MHz when said organic semiconductor material in an isotropic phase state is held between a pair of opposed substrates with an interelectrode spacing of 9 μm, ~~and~~ wherein the functional layer has been formed by heating said organic semiconductor material to a temperature high enough for the organic semiconductor material to exhibit at least a smectic phase and then cooling the organic semiconductor material, and at least a part of the organic semiconductor material is in an aligned crystal phase. - -

Reasons for Allowance

5. The following is an examiner's statement of reasons for allowance.

6. The closest cited prior art of record, JP 2001-075297 fails to fairly teach or suggest, even in view of US 4,141,627, an organic semiconductor element comprising a functional layer comprising an aligned organic semiconductor material wherein the organic semiconductor material has rodlike low-molecular smectic liquid crystallinity, and comprises a skeleton structure comprising: L 6 π electron aromatic rings, M 10 π electron aromatic rings, and N 14 π electron aromatic rings, wherein L, M, and N are each an integer of 0 (zero) to 4 and L + M + N = 1 to 4; and a terminal structure attached to both ends of said skeleton structure, said terminal structure developing smectic liquid crystallinity, the charge mobility of said organic semiconductor material is not less than 5×10^{-3} $cm^2 V^{-1} s^{-1}$ when in a crystalline phase and not less than 5×10^{-2} $cm^2 V^{-1} s^{-1}$ when in a liquid crystal phase, and the phase angle Θ of impedance of said organic semiconductor material is $-80^\circ \leq \Theta \leq -90^\circ$ as determined in the measurement of impedance in a frequency f range of 100 Hz ≤ f ≤ 1 MHz when said organic semiconductor material in an isotropic phase state is held between a pair of opposed substrates with an interelectrode spacing of 9 μm, wherein the functional layer has been formed by heating said organic semiconductor material to a temperature high enough for the organic semiconductor material to exhibit at least a smectic phase and then cooling the organic semiconductor material, and at least a part of the organic semiconductor material is in an aligned crystal phase.

None of the references teach the combination of rod-like low-molecular smectic liquid crystallinity with a charge mobility of not less than 5 x 10^{-3} cm^2 V^{-1} s^{-1} when the organic semiconductor material is in a solid crystalline phase and not less than 5 x 10^{-2} cm^2 V^{-1} s^{-1} when in a liquid crystal phase, with a phase angle Θ of impedance of $-80^\circ \leq \Theta \leq -90^\circ$ as determined in the measurement of impedance in a frequency f range of 100 Hz ≤ f ≤ 1 MHz when said organic semiconductor material in an isotropic phase state is held between a pair of opposed substrates with an interelectrode spacing of 9 μm. See Fig. 1 of Applicant's specification. While '297 teaches that electrical conduction by ions is not desirable (ionic conduction, abstract), but that it becomes dominant when the electron and positive hole mobilities are not greater than 1 x 10^{-5} cm^2 V^{-1} s^{-1}, '297 fails to teach that the ionic impurities need to be removed in such a way that the organic semiconductor material has a charge mobility of not less than 5 x 10^{-3} cm^2 V^{-1} s^{-1} when the organic semiconductor material is in a solid crystalline phase and not less than 5 x 10^{-2} cm^2 V^{-1} s^{-1} when in a liquid crystal phase, and has a phase angle Θ of impedance of $-80^\circ \leq \Theta \leq -90^\circ$ as determined in the measurement of impedance in a frequency f range of 100 Hz ≤ f ≤ 1 MHz when said organic semiconductor material in an isotropic phase state is held between a pair of opposed substrates with an interelectrode spacing of 9 μm. While '627 teaches removing all impurities, including ionic ones, '627 does not teach the specific removal of the ionic impurities to provide a semiconductor material with an increased charge mobility. Semiconductor materials are ordinarily doped with impurities to increase the charge mobility.

4. US 7,102,154 does not qualify as prior art since the group of inventors, Jun-Ichi Hanna, Hiroki Maeda and Masanori Akada, is a subset of the group of inventors of the presently examined application.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication should be directed to Sow-Fun Hon whose telephone number is (571)272-1492. The examiner can normally be reached Monday to Friday from 10:00 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Terrel Morris, can be reached at (571)272-1478. The fax phone number for the organization where this application or proceeding is assigned is (571)273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Sophie Hon/
Sow-Fun Hon

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Supervisory Patent Examiner